DECLARATION

I, Clarence P. FELDMANN, of Grossackerstrasse 9, CH-8152 Opfikon, Switzerland, do hereby declare that I am conversant with the English and German languages and am a competent translator thereof. I declare further that the following is a true and correct translation made by me of the original text of the International Publication No. WO 03/057585 A2 (International Application No. PCT/CH03/00004).

June 16, 2004

C. Feldmann

.....

Clarence P. Feldmann

EXPRESS MAIL NO. EV502028380US

MAILED 09 July 2004

10/501178
DT15 Rec'd PCT/PTO 09 JUL 2004

A plastic closure able to be manufactured in the closed state, as well as an injection mould and method for its manufacture.

The present invention relates to a plastic closure comprising a lower part and a cap and a snap hinge, via which the two closure parts are connected to one another as one piece, wherein the lower part and the cap are able to be manufactured in the closed state and additionally connected to one another via at least one separation seam. The invention relates further to an injection mould for manufacturing such plastic closures as well as additionally to a method with which the above-mentioned closures may be manufactured whilst using the injection moulds according to the invention.

Closures of the initially mentioned type are known for example from CH-A-673'631. With this it is the case of a plastic closure whose lower part may be placed on a bottle neck or onto an adapter fastened on the bottle neck. The snap effect of the closure is produced with a spring element which is a bending spring which projects from the container wall from the outside into the inner space of the closure. On account of this, the snap effect is not achieved by the deformation of the container walls but solely by the restoring force of the U-shaped spring element.

Openings in the closure walls of the plastic closure are absolutely necessary for manufacturing the known plastic closures. On the one hand an opening needs to be present in the outer, peripheral lateral wall (skirt) in order to shape the U-shaped spring on the inner side, and on the other hand a recess needs to be present in the cover surface in order to achieve the upper, outer surface of the U-shaped spring.

The manufacture of such a closure as a result of this necessitates relatively large mould slides or sliders which on the one hand renders the injection moulds considerably more expensive and on the other hand extends the cycle times. Accordingly, plastic closures of this known type as a result are relatively expensive and up to the present day could not assert themselves on the market.

Finally the lack of design freedom is a problem which can hardly be solved. The manufacturability specifically compellingly requires a conical or step-like shaping of the plastic closure, wherein the lateral walls of the cap with respect to the lower part need to be arranged offset to one another at least by the wall thickness.

The same concept as in CH-A-673'631 has also been realised in CH-683'611. Here too the plastic closure which is injected in the closed state is realised by way of arranging the lower part and the cap conically on top of one another. Here, in contrast to the first mentioned design

one however realises a snap hinge which is not achieved by way of a spring element designed as a bending spring, but by way of two flat intermediate elements via which the tensile forces are transmitted, wherein however the spring force is realised solely by the deformation of the adjacent container walls. At the same time it is necessary for the container walls of the lower part and the cap to run inclined towards the centre axis at least in the hinge region. Although such a closure may be manufactured without a slider, it may not however be used on conventional bottle necks without an adapter. The necessary conicity results in a diameter difference between the lower part and the sealing peg in the cap which is larger than common bottle necks.

It is therefore the object of the present invention to provide a plastic closure of the initially mentioned type which requires only particularly simple injection moulds, may be accordingly manufactured with short cycle times and permits a cylindrical shaping of the outer contour.

This object is achieved by a plastic closure of the initially mentioned type with the characterising features of patent claim 1.

A further object of the present invention is to manufacture an injection mould for manufacturing plastic closures of the above mentioned type, which are extremely economical in manufacture and may function with short cycle times.

An injection mould with the features of patent claim 16 achieves this object.

Finally the invention also relates to a method for manufacturing the closures of the initially mentioned type whilst using the previously mentioned injection mould, said method having the features of patent claim 19. Further design forms of the respective invention are to be deduced from the dependent claims and their significance is explained in the subsequent description.

A preferred embodiment example of the plastic closure according to the invention is represented in the accompanying drawing, whereby a representation of the injection mould as well as a schematic representation of the method is not made since the man skilled in the art would not require such a representation on account of the subsequent explanations.

The single preferred embodiment example of the plastic closure according to the invention is shown in the drawings. There are shown in:

Figure 1 a lateral view of the plastic closure according to the invention manufactured in the closed state, placed onto a partly shown container neck and

Figure 2 the same view after removal of the guarantee strip and

Figure 3 again the same plastic closure, this time in a diametric vertical section in the opened condition and finally

Figure 4 a vertical section through the plastic closure according to Figure 1 before opening for the first time, again shown placed onto a container neck.

The plastic closure manufacturable in the closed state is shown in its entirety at 1. It comprises a lower part 2 and a cap 3. The lower part 2 and the cap 3 are rotationally symmetrical with regard to the centre axis A. The lower part 2 comprises a lateral wall (skirt) 5 and the cap 3 a lateral wall (skirt) 6. The lower part 2 and the cap 3 are connected to one another as one piece via a snap hinge 4. Furthermore the lower part 2 and the cap 3 are connected to one another via at least one separation seam 7. At the same time the at least one separation seam 7 always runs from one side of the snap hinge 4 circumferentially about the periphery of the plastic closure 1 to the other side of the snap hinge 4. The separation seam 7 may be formed by a continuous separation line which is only interrupted by several destroyable bridges. In the preferred example shown here it is however the case of continuous thin locations which form a so-called tear seam. These tear seams 8 in particular may be clearly seen in Figure 4 in which the closure is shown in an enlarged scale. Here it is conspicuous that not a single tear seam 7 is present but that there are two tear seams 7 and 7' running parallel to one another between which a guarantee strip 9 is present. This guarantee strip 9 at least on one side in the vicinity of the snap hinge 4 comprises a tear-open tab 10. In the normal case and the preferred solution the closure is not only rotationally symmetrical with respect to the axis A, but the lateral walls 5,6 represent sections of the same circular cylinder. The lateral walls 5,6 are thus situated vertically on top of one another in a completely flush manner. Thanks to this shaping the closure may also be used on standard bottle necks. As a result of this, the container B requires no specially shaped bottle neck F. The cap 3 may thus be provided with an annular sealing wall 10 which forms a sealing plug 11 which comes to lie directly into the bottle neck F in a sealing manner without an adapter piece. By way of this not only are the manufacturing costs saved but also the assembly costs. The closure represented here may be pressed onto the container with conventional assembly machines without any problem and with a large cadence. In particular, on account of the use of continuous tear seam 8, there also exists no danger that the fragile bridges are destroyed in the region of the separation seam during assembly. The fastening of the closure 1 on the container neck F is effected with conventional means which are directly integrally formed on the lateral wall (skirt) 5 of the lower part 2. In the shown example this is an inwardly projecting peripheral retaining bead 12. Instead of the retaining bead 12 one may of course also provide retaining bead sections. In particular, in the Figures 1 and 4 one may clearly see that the lateral walls of the upper part

and the lower part in the embodiment shown here are completely smooth on the outer surface. In contrast to this, the inner surfaces of the lateral walls of the upper part and lower part comprise inward formations and outward formations. Inward formations and outward formations are to be understood here as changes in the wall thickness, wherein recesses in the lateral wall (skirt) surface are indicated as inward formations which are considered here whilst outward formations are considered here as protuberances with respect to the lateral wall (skirt) surface. In the example shown here, all inward formations and outward formations are arranged on the inner surface of the lateral walls of the lower part and lid. This is definitely the most sensible design but it is also not ruled out to incorporate all inward formations and outward formations on the outer surfaces of the lower part and the lid. For achieving the object according to the invention it is absolutely necessary for the snap hinge to lie in the lateral wall (skirt) regions of the closure which run parallel to the closure and opening movement direction of the injection mould. An injection mould in the simplest case consists of two tool halves. These tools are mostly also called plates. Whilst the one tool half comprises cavities which form the outer surfaces of the closure manufactured therein, the other tool half comprises so-called mandrels which when traversing together the two tool halves enter the cavities of the other tool half. The remaining cavity is filled with plastic and forms the plastic closure to be produced. Whilst one was earlier of the opinion that no shape deviations from this movement direction are allowable on the lateral walls which run parallel to the opening and closure movement without suitable sliders or other moving parts being provided on the injection mould, today one has one has moved away from this position. In particular, threads on closures or retaining beads are regarded as being as permissible. It is essential that firstly the two injection mould parts are traversed apart, so that the material may escape at least on one side, in order to completely remove the respective injection mould object from the mould. The plastic closure according to the invention was conceived in its entire design on the basis of this discovery. In particular with snap hinge closures, this manufacturing concept until now has never been used for producing the snap hinge. Particularly aesthetic closures result from this concept if the lateral walls of the lower part 2 and the cap 3 at least in the region of the snap hinge are arranged lying in a flush manner on top of one another. With this, the region is to be understood as a cylinder sector, that is to say the regions of the snap hinge up to the cover surface 13 of the lid, and from the snap hinge 4 to the lower edge 14 of the lower part 2 lie on top of one another in a completely flush manner. The adjacent wall regions may however indeed be designed running in an inclined manner. This however in not desirable in many cases. Accordingly one would preferably arrange the lateral walls 5, 6 lying on top of one another in a completely flush manner.

As already mentioned, only the inner surfaces or only the outer surfaces should have inward formations and/or outward formations. These inward formations and/or outward formations may at the same time not exceed the wall thickness of the lateral walls. This of course is to be understood within the framework of the usual accuracies and tolerances. Of course, the

larger the total diameter of the closure, the larger the relative deviation may be. This of course is known to the man skilled in the art of plastics technology, and does not have to be explained any further.

One is relatively free with regard to the shaping of the guarantee strip. However the guarantee strip 9 as well as the tab 10 always in practise form part regions of the lateral walls 5, 6 which lie on top of one another. The closure may only be opened by tearing away the guarantee strip 9. As already mentioned and represented in the drawing, the separation seams 7, 7' which delimit the guarantee strip run parallel to one another. If both separation seams run parallel to one another then they may run perpendicular or inclined relative to the centre axis or to the centric middle axis A of the closure. Of course the separation seams 7, 7' may also be arranged in planes running differently to the centric middle axis A, wherein in the special case the one separation seam may run perpendicularly to the centric middle axis and the second separation seam 7 may run inclined to the centric middle axis A.

The snap hinge which was applied here corresponds essentially to a snap hinge as is known from EP-A-0'056'469 or from US-A-3,135,456. These are snap hinges which are formed essentially of two film hinges. Whilst the one film hinge 41 represents the movable connection between the lateral wall (skirt) 6 of the cap 3 and an intermediate element 43, the second film hinge 42 forms the separation line between the lateral wall (skirt) 5 of the lower part 2 and the mentioned intermediate element 43 of the snap hinge 4. The snap hinge has lateral limitations 44 which are formed by a gap. The film hinges 41, 42 between the two lateral limitations 44 may have various running directions. With regard to this, the previously mentioned documents are referred to. Basically however the film hinges 41, 42 may centrally approach one another or run part between the two limitations 44. Furthermore the film hinges may have an arcuate course, or one which is sharply bent, and they may approach one another to such an extent that they mutually contact, by which means two lateral intermediate elements 45 transmitting tensile forces arise. As already mentioned, the lateral limitations 44 are separated from the lateral walls 5, 6 by a gap. This gap 46 thus forms the separation between the intermediate element or the intermediate elements or between the elements and the adjacent lateral walls 5,6. However the lateral limitations 44 may however also be connected to the adjacent lateral walls practically as an additional guarantee element, wherein these connections need to be designed as separation seams. When opening the closure for the first time, these separation seams would tear.

As already mentioned, the plastic closures according to the invention may be manufactured by way of injection moulds, wherein an injection mould consists of two plates of which the one plate comprises the cores and the other plate the cavities. At the same time at least one of the two plates has no recesses or protuberances on the surfaces parallel to the extension direction of the plate. Accordingly plastic closures which are manufactured by way of these

injection moulds have no inward formations or outward formations on the corresponding lateral wall (skirt) surfaces. For the manufacture of the closures as are represented in the Figures 1 to 4, the plate with the mandrels with the surfaces parallel to the extension direction have protuberances and/or recesses which form the corresponding outward formations and/or inward formations, whilst the cavities on the other plate on the surfaces lying parallel to the extension direction have no recesses or protuberances whatsoever. Of course a corresponding reversion is likewise possible, as is specified in claim 17.

If one operates with the just described injection moulds in order to shape the corresponding closures it is thus necessary to firstly extend that plate which has no recesses or protuberances on the surfaces running parallel to the extension direction. If then the closures are set free on one side, then they may be ejected under suitable elastic deformation from the other plate on which corresponding recesses or protuberances are present parallel to the extension and retraction direction of the moulds. Usually, with this, as already mentioned, one would shape the cavities free of recesses and protuberances. Accordingly firstly the plate comprising the cavities is retracted and after this the cores are pulled from the closures. Again, a reversion is also possible here. If the closures have smooth inner surfaces of the lateral walls, one may then firstly pull the cores from the closures and of course after this eject the closures from the cavities.

List of reference numerals

A	centre axis
B	container
F	bottle neck

1	plastic closure
2	lower part
3	lid
4	snap hinge
5	lateral wall (skirt) of the lower part
6	lateral wall (skirt) of the lid
7	separation seam
8	tear seam
9	guarantee strip
10	annular wall
11	sealing plug
12	retaining bead
13	cover surface
14	lower edge of the lower part 2
41	film hinge
42	film hinge
43	intermediate element
44	lateral limitation
45	intermediate element
46	gap